Oakley Sound Systems

Oakley Modular Eurorack Series

RM4014 Ring Modulator

PCB Issue 3E

User Manual

V3.1

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Introduction

This is the User Manual for the issue 3E RM4014 Ring Modulator Eurorack module from Oakley Sound. This document contains an overview of the operation of the unit and the calibration procedure.

For the Builder's Guide, which contains a basic introduction to the board, a full parts list for the components needed to populate the board or boards, and a list of the various interconnections, please visit the main project webpage at:

http://www.oakleysound.com/ringmod-e.htm

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

For general information on how to build our modules, including circuit board population, mounting front panel components and making up board interconnects please see our generic Construction Guide at the project webpage or http://www.oakleysound.com/construct.pdf.

Power Supply

This module requires +/-12V at approximately 35mA. Power is admitted to the module via the usual 10 way IDC header.

The -12V connection is to be made to the bottom of the module. The standard rule of 'red stripe down' is to be observed.

The Oakley RM4014 Ring Modulator

The prototype 8hp wide Oakley Ring Modulator. The faceplate is a natural finish panel from Scheaffer.

This is a vintage ring modulator design with bags of character. It is based on the classic ARP4014 sub-module which was used on the ARP2500 modular and ARP2600 semi-modular synthesisers. The design has a fully discrete core but uses two op-amps for input and output amplification.

A ring modulator has two main inputs, usually called X and Y, and one output. The output voltage is the product of the two input voltages. In other words it multiplies the two input signals together to produce a new and different sounding output. If you have two sine wave input signals then the output will have both the sum and difference frequencies. For example, if X is a 440Hz sine wave and Y a 40Hz, you would get a 480Hz and a 400Hz sine wave from

the output. However, this is only really true in a perfect ring modulator, and this ring modulator is not that. Each input has its own differing non-linearities or imperfections. This greatly adds to the character of the resultant output.

The Oakley Ring Modulator features three rotary control pots. Each input has its own attenuator, and there's also a offset control for the Y input. In conjunction with the Y attenuator, this third pot effectively acts as a wet-dry control for the X input. But because of the non-linearities inherent in the design it also acts in more subtle ways.

You can also use the Oakley Ring Mod as a standard VCA. Just use the Y input as your CV input and X will be shaped accordingly. Each input can be either direct coupled (DC) or high pass filtered (AC). The former allows DC and low frequency signals to be processed. While the latter provides a DC block to process only alternating frequencies. The standard panel design makes both types of input available with each having its own socket. You can use both inputs on each of the X and Y inputs at the same time. Input signals will be summed together so you can also use the RM-4014 as a simple audio mixer.

Calibration

There are three trimmers on the PCB which need adjusting correctly to get the best out of the ring modulator module. It is important that you adjust these in your modular as the settings are affected by the power supply voltages.

Allow the modular and ring modulator to warm up for 15 minutes.

BAL1: Turn down X LEVEL and Y LEVEL pots to their minimum settings. Turn the Y OFFSET pot to its maximum level. Measure the output voltage from the output socket with a good digital voltmeter. Adjust BAL1 until the output voltage is 0.000V +/- 5mV.

BAL2: Insert a triangle wave signal at 440Hz to the IN Y AC input. Turn down the Y OFFSET pot to its minimum setting. Turn up the Y LEVEL to full. If you have a 'scope then adjust BAL2 until the signal seen at the output socket is minimised as much as possible. It will not go away completely. If you haven't got a scope then use your ears with your monitoring amp turned up somewhat. Adjust BAL2 until the sound from the output socket is at its smallest level. You will not get rid of it completely, the ring modulator is not perfect and as such it will leak or bleedthrough. Once you have done this remember to turn your amp down if you have turned it up high.

GAIN: Ensure that the Y LEVEL is set to minimum, but the other two pots to their maximum. Insert an audio signal into IN X (DC) and adjust GAIN so that the output signal is at the same level or volume as the input. That is, if you have a 5V peak signal inserted into IN X, then you should adjust GAIN for a 5V peak signal at the output.

Once that is completed the unit is ready to be used to make music, or just daft noises...

Final Comments

I hope you enjoy using the Oakley Ring Modulator module.

If you have any problems with the module, an excellent source of support is the Oakley Sound Forum at Muffwiggler.com. Paul Darlow and I are on this group, as well as many other users and builders of Oakley modules.

If you have a comment about this user manual, or have a found a mistake in it, then please do let me know.

Last but not least, can I say a big thank you to all of you who helped and inspired me. Thanks especially to all those nice people on the Synth-DIY and Analogue Heaven mailing lists, and at Muffwiggler.com.

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